

CLAIMS AS FILED NOVEMBER 6, 2001

CLAIMS

What is claimed is:

1. A magnetic induction time-multiplexed two-way short-range wireless communications system, comprising:

a first unit for receiving first unit input signals and providing first unit output signals, the first unit including a first unit transducer system for generating a first inductive field based upon the first unit input signals during a first time slot and for receiving a second inductive field during a second time slot, the first unit transducer system comprising at least one transducer, a first unit processing circuit for modulating the first unit input signals during the first time slot, driving the at least one transducer with the modulated first unit input signals during the first time slot to cause the at least one transducer to generate the first inductive field, and receiving and demodulating the second inductive field to produce the first unit output signals during the second time slot, and a first unit interface circuit for matching the first unit transducer system to the first unit processing circuit; and

a second unit for receiving second unit input signals and providing second unit output signals, the second unit including a second unit transducer system for generating the second inductive field based upon the second unit input signals during the second time slot and for receiving the first inductive field during the first time slot, the second unit transducer

system comprising at least three transducers wherein each of the at least three transducers is arranged orthogonally with respect to the other transducers, a second unit processing circuit for modulating the second unit input signals during the second time slot, driving one of the at least three orthogonal transducers with the modulated second unit input signals during the second time slot to cause the one of the at least three orthogonal transducers to generate the second inductive field, and receiving and demodulating the first inductive field to produce the second unit output signals during the first time slot, a second unit interface circuit for matching the second unit transducer system to the second unit processing circuit, and

a second unit switch network for coupling one of the at least three orthogonal transducers to the second unit interface circuit.

2. The system of claim 1 wherein the first unit transducer system comprises a single transducer.
3. The system of claim 2 wherein the single transducer comprises a rod antenna.
4. The system of claim 1 wherein each of the at least three orthogonal transducers of the second unit transducer system comprises a rod antenna.
5. A method for magnetic induction time-multiplexed two-way short-range wireless communications, comprising:

during a first period of time, generating from a first unit with a first unit transducer system a first inductive field and receiving the first inductive field at a second unit with a second unit transducer system, the first transducer system including multiple transducers; and

during a second period of time, generating from the second unit with the second unit transducer system a second inductive field and receiving the second inductive field at the first unit with the first transducer system.

6. A method for communicating information over wireless links, the method comprising:

generating a varying magnetic field from a first unit during a first time slot to transmit information over a wireless link; and

generating a varying magnetic field from a second unit during a second time slot to transmit information over the wireless link.

7. A method as in claim 6, wherein the first unit includes multiple transducers, at least one of which functions as both a transmitter and receiver of a varying magnetic field.

8. A method as in claim 7 further comprising:

positioning each of the multiple transducers in the first unit to be uniquely oriented with respect to each other.

9. A method as in claim 7 further comprising:

transmitting information from the second unit to

the first unit; and

selecting a transducer of the first unit to generate a varying magnetic field depending on which of the multiple transducers in the first unit receives a strongest signal from the second unit.

10. A method as in claim 8 further comprising:

disposing a single transducer in the second unit for receiving information from the first unit and transmitting information from the second unit over the single transducer to the first unit.

11. A method as in claim 6 further comprising:

selecting a carrier frequency for transmitting information over the wireless link to avoid interference.

12. A method as in claim 6, wherein the first unit and second units are portable transceiver devices.

13. A method as in claim 6, wherein the second unit is disposed in a concha type headset.

14. A method as in claim 6 further comprising:

transmitting termination bits at the end of a time slot.

15. A method as in claim 6 further comprising:

compressing the information for transmission during a time slot.

16. A method as in claim 6 further comprising:

modulating the information onto a carrier

frequency for transmission during a time slot.

17. A method as in claim 6 further comprising:
 encrypting the information for transmission
 during a time slot.
18. A method as in claim 6, wherein the first unit
 transmits to the second unit during the first time
 slot and the second unit transmits to the first unit
 during the second time slot.
19. A method as in claim 18, wherein the second unit is
 disposed in a headset including a speaker and
 microphone, and the first unit is disposed in a
 cellular telephone device.
20. A method as in claim 18, wherein the wireless link
 between the first unit and second units support two-
 way half duplex communication.
21. A method as in claim 18, wherein the first unit
 transmits information over one of three transducers
 and the second unit transmits and receives over a
 single transducer.
22. A method as in claim 18, wherein an orientation of the
 first unit relative to the second unit changes over
 time.
23. A method as in claim 18, wherein the first unit is
 coupled to a communications network and the wireless
 link between the second unit and first unit is part of
 a logical connection between the second unit and the

communications network.

24. A method as in claim 18 further comprising:
 - detecting which of multiple transducers disposed in the first unit produces a strongest received signal from the second unit; and
 - generating a varying magnetic field in a time slot from the first unit on a transducer device oriented on a similar axes as the transducer that produces the strongest received signal.
25. A method as in claim 24, wherein the first unit detects which of multiple transducers receives a strongest signal in a previous time slot to transmit on that transducer in a following time slot.
26. A method as in claim 18 further comprising:
 - utilizing a portion of the first time slot to transmit synchronization information from the first unit to the second unit.
27. A method as in claim 26 further comprising:
 - synchronizing the second unit to receive during the first time slot based on received synchronization information from the first unit.
28. A method as in claim 26 further comprising:
 - at the second unit, receiving data information from the first unit following receipt of the synchronization information.
29. A method as in claim 18 further comprising:
 - tracking movements of the first unit relative to

the second unit for maintaining communication over the wireless link.

30. A method as in claim 18 further comprising:
at the first unit, processing data information received in a previous time slot while transmitting to the second unit in a following time slot.
31. A method for communicating information over a wireless link, the method comprising:
from a first unit, generating a varying magnetic field to transmit synchronization information and data information over the wireless link;
at a second unit, receiving the varying magnetic field and using the synchronization information to synchronize the second unit to receive the data information over the wireless link.
32. A method as in claim 31, wherein the synchronization information is a header including multiple bits.
33. A method as in claim 31, wherein the first unit includes multiple transducers, at least one of which functions as both a transmitter and receiver of a varying magnetic field.
34. A method as in claim 33 further comprising:
positioning each of multiple transducers in the first unit to be uniquely oriented with respect to each other.
35. A method as in claim 34 further comprising:
transmitting a signal from the second unit; and

selecting a transducer of the first unit to generate a varying magnetic field depending on which of the multiple transducers receives a strongest signal from the second unit.

36. A method as in claim 34 further comprising:
disposing a single transducer in the second unit for receiving information from the first unit and transmitting information from the single transducer in the second unit to the first unit.
37. A method as in claim 31, wherein the wireless link between the first unit and second unit supports two-way full duplex communication.
38. A method as in claim 31, wherein the first unit transmits information over one of three transducers and the second unit transmits and receives over a single transducer.
39. A method as in claim 31, wherein the second unit is disposed in a headset including a speaker and microphone, and the first unit is disposed in a cellular telephone device.
40. A method as in claim 31, wherein an orientation of the first unit and second unit changes over time.
41. A method as in claim 31 further comprising:
selecting a carrier frequency for transmitting information over the wireless link to avoid interference.

42. A method as in claim 31, wherein the first unit is a portable transceiver device.
43. A method as in claim 42, wherein the second unit is a portable transceiver device.
44. A method as in claim 31, wherein the first unit is coupled to a communications network and the wireless link is part of a logical connection between the second unit and the communications network.
45. A method as in claim 31 further comprising:
 - transmitting a signal from the second unit; and
 - detecting which of multiple transducers disposed in the first unit produces a strongest received signal from the second unit; and
 - generating a varying magnetic field in a time slot from the first unit on a transducer device oriented on similar axes as the transducer that produces the strongest received signal.
46. A method as in claim 31 further comprising:
 - at the second unit, receiving data information from the first unit following receipt of the .. synchronization information.
47. A method as in claim 31, wherein the second unit is disposed in a concha type headset.
48. A method as in claim 31 further comprising:
 - utilizing a portion of the time slot to transmit synchronization information from the first unit to the second unit.

49. A method as in claim 48 further comprising:
synchronizing the second unit to receive in the
time slot based on received synchronization
information.
50. A method as in claim 45, wherein the first unit
detects which of multiple transducers receives a
strongest signal in a previous time slot to transmit
on the transducer in a following time slot.
51. A method as in claim 31 further comprising:
tracking movements of the first unit relative to
the second unit for maintaining communication over the
wireless link.
52. A method as in claim 31 further comprising:
transmitting termination bits at the end of a
time slot.
53. A method as in claim 31 further comprising:
compressing the information for transmission over
the wireless link in a time slot.
54. A method as in claim 31 wherein the step of
transmitting further comprises:
modulating the information onto a carrier
frequency for transmission from the first unit to the
second unit.
55. A method as in claim 31 further comprising:
processing data information received in a
previous time slot while transmitting in a reverse
direction in a following time slot.
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56. A method as in claim 31 further comprising:
 encrypting the information for transmission over
 the wireless link in a time slot.
57. A system for communicating information over wireless
links, the system comprising:
 a first unit including at least two transducers
to transmit and receive, the first unit generating a
varying magnetic field during a first time slot to
transmit information; and
 a second unit including at least one transducer
to transmit and receive, the second unit receiving the
varying magnetic field during the first time slot to
receive the information transmitted by the first unit,
the second unit transmitting information to the first
unit during a second time slot not overlapping with
the first time slot.
58. A system as in claim 57, wherein one or more
transducers in the first unit functions as both a
transmitter and receiver of a varying magnetic field.
59. A system as in claim 58, wherein the at least two
transducers in the first unit are uniquely oriented
with respect to each other.
60. A system in claim 58, wherein a transducer of the
first unit generates a varying magnetic field
depending on which of the at least two transducers
receives a strongest signal from the second unit.
61. A system as in claim 58, wherein a single transducer
is disposed in the second unit for receiving

information from the first unit and transmitting information to the first unit.

62. A system as in claim 57, wherein the wireless link between the first unit and second unit supports two-way full duplex communication.
63. A method as in claim 57, wherein the first unit transmits information over one of three uniquely oriented transducers and the second unit transmits and receives over a single transducer.
64. A system as in claim 57, wherein the second unit is disposed in a headset including a speaker and microphone, and the first unit is disposed in a cellular telephone device.
65. A system as in claim 57, wherein an orientation of the first unit and second unit changes over time due to motion of a user.
66. A system as in claim 57, wherein a carrier frequency is selected for transmitting information over the wireless link to avoid interference.
67. A system as in claim 57, wherein the first unit is a portable transceiver device.
68. A system as in claim 67, wherein the second unit is a portable transceiver device.
69. A system as in claim 57, wherein the first unit is coupled to a communications network and the wireless

link between the second unit and first unit is part of a logical connection between the second unit and the communications network.

70. A system as in claim 57 further comprising:
 - a first circuit to detect which of multiple transducers disposed in the first unit produces a strongest received signal from the second unit; and
 - a second circuit to generate a varying magnetic field in a time slot from the first unit on a transducer device oriented on a similar axes as the transducer that produces the strongest received signal.
71. A system as in claim 70, wherein the first unit detects which of multiple transducers receives a strongest signal in a previous time slot to transmit on the transducer in a following time slot.
72. A system as in claim 57, wherein the second unit is disposed in a concha type headset.
73. A system as in claim 57, wherein a portion of the time slot is used to transmit synchronization information from the first unit to the second unit.
74. A system as in claim 73, wherein the second unit synchronizes to receive in the time slot based on the received synchronization information.
75. A system as in claim 73, wherein the second unit receives data information from the first unit following receipt of the synchronization information

in the time slot.

76. A system as in claim 57, wherein movements of the first unit relative to the second unit are tracked for maintaining communication over the wireless link.
77. A system as in claim 57, termination bits are transmitted at the end of a time slot.
78. A system as in claim 57, wherein the information is compressed for transmission over the wireless link in a time slot.
79. A system as in claim 57, wherein the information is modulated onto a carrier frequency for transmission from the first unit to the second unit.
80. A system as in claim 57, wherein data information received in a previous time slot is processed while other data information is transmitted in a reverse direction in a following time slot.
81. A system as in claim 57, wherein the information is encrypted for transmission over the wireless link in a time slot.
82. A system for communicating information over a wireless link, the system comprising:
 - a first unit including at least two transducers to transmit and receive, the first unit generating a varying magnetic field to transmit synchronization information and data information over the wireless link; and

a second unit including at least one transducer to transmit and receive, the first and second units being movable relative to each other, the second unit receiving the varying magnetic field and using the synchronization information to receive the data information over the wireless link.

83. A system as in claim 82, wherein one or more transducers in the first unit functions as both a transmitter and receiver of a varying magnetic field.
84. A system as in claim 83, wherein the at least two transducers in the first unit are uniquely oriented with respect to each other.
85. A system in claim 83, wherein a transducer of the first unit generates a varying magnetic field depending on which of the at least two transducers receives a strongest signal from the second unit.
86. A system as in claim 83, wherein a single transducer is disposed in the second unit for receiving information from the first unit and transmitting information to the first unit.
87. A system as in claim 82, wherein the wireless link between the first unit and second unit supports two-way full duplex communication.
88. A method as in claim 82, wherein the first unit transmits information over one of three uniquely oriented transducers and the second unit transmits and receives over a single transducer.

89. A system as in claim 82, wherein the second unit is disposed in a headset including a speaker and microphone, and the first unit is disposed in a cellular telephone device.
90. A system as in claim 82, wherein an orientation of the first unit and second unit changes over time due to motion of a user.
91. A system as in claim 82, wherein a carrier frequency is selected for transmitting information over the wireless link to avoid interference.
92. A system as in claim 82, wherein the first unit is a portable transceiver device.
93. A system as in claim 92, wherein the second unit is a portable transceiver device.
94. A system as in claim 82, wherein the first unit is coupled to a communications network and the wireless link between the second unit and first unit is part of a logical connection between the second unit and the communications network.
95. A system as in claim 82 further comprising:
 - a first circuit to detect which of multiple transducers disposed in the first unit produces a strongest received signal from the second unit; and
 - a second circuit to generate a varying magnetic field in a time slot from the first unit on a transducer device oriented on a similar axes as the transducer that produces the strongest received

signal.

96. A system as in claim 82, wherein the first unit detects which of multiple transducers receives a strongest signal in a previous time slot to transmit on the transducer in a following time slot.
97. A system as in claim 82, wherein the second unit is disposed in a concha type headset.
98. A system as in claim 82, wherein a portion of the time slot is used to transmit synchronization information from the first unit to the second unit.
99. A system as in claim 98, wherein the second unit synchronizes to receive in the time slot based on the received synchronization information.
100. A system as in claim 99, wherein the second unit receives data information from the first unit following receipt of the synchronization information in the time slot.
101. A system as in claim 82, wherein movements of the first unit relative to the second unit are tracked for maintaining communication over the wireless link.
102. A system as in claim 82, termination bits are transmitted at the end of a time slot.
103. A system as in claim 82, wherein the information is compressed for transmission over the wireless link in a time slot.

104. A system as in claim 82, wherein the information is modulated onto a carrier frequency for transmission from the first unit to the second unit.

105. A system as in claim 82, wherein data information received in a previous time slot is processed while other data information is transmitted in a reverse direction in a following time slot.

106. A system as in claim 82, wherein the information is encrypted for transmission over the wireless link in a time slot.

CLAIM COUNT

6 I

1 I	26 D	51 D	76 D
2 D	27 D	52 D	77 D
3 D	28 D	53 D	78 D
4 D	29 D	54 D	79 D
5 I	30 D	55 D	80 D
6 I	31 I	56 D	81 D
7 D	32 D	57 I	82 I
8 D	33 D	58 D	83 D
9 D	34 D	59 D	84 D
10 D	35 D	60 D	85 D
11 D	36 D	61 D	86 D
12 D	37 D	62 D	87 D
13 D	38 D	63 D	88 D
14 D	39 D	64 D	89 D
15 D	40 D	65 D	90 D
16 D	41 D	66 D	91 D
17 D	42 D	67 D	92 D
18 D	43 D	68 D	93 D
19 D	44 D	69 D	94 D
20 D	45 D	70 D	95 D
21 D	46 D	71 D	96 D
22 D	47 D	72 D	97 D
23 D	48 D	73 D	98 D
24 D	49 D	74 D	99 D
25 D	50 D	75 D	100 D

Total: 166

→ 106
Indep: 6